National Strategy for Electronics Stewardship:

Accomplishments Report

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Co-Chairs:
U.S. Environmental Protection Agency
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Introduction

Electronic devices are an integral part of our daily lives. While these products enhance our lives, they may also have significant human health and environmental impacts during the product's life cycle. Many of these impacts can be addressed through more sustainable and responsible management in both the public and private sectors.

In 2014, over 720 million new electronic products were sold and 3.36 million tons of used electronics were ready for end-of-life management in the United States.[i] With the continued increase in number and type of electronic product, these numbers are expected to increase each year. In order to lead and encourage responsible global life cycle management, the U.S. government has prioritized electronics stewardship by acknowledging both the opportunities and issues these technologies present.

In 2010, the federal community worked together as an interagency Task Force to "prepare a national strategy for responsible electronics stewardship." In July 2011, the Task Force released *the National Strategy for Electronics Stewardship* (NSES), establishing a unified framework to evolve electronics stewardship throughout the products' life cycle.

The convening of the Task Force and the development of the NSES brought together 16 federal agencies to focus on electronics stewardship and to define a pathway for action to demonstrate federal leadership on this issue. The Task Force identified and implemented 46 actions over the course of the last six years. Some actions were distinct and are completed, while others were meant to be ongoing and to adjust to the evolving world of electronics. Some of the efforts that were set in motion prior to the NSES have matured or been built upon and expanded.

This report charts the progress and accomplishments of the NSES in addressing sustainable management of electronics and highlights the benefits of continued leadership from the federal government. It also considers the future role of the U.S. government as new and different electronics become part of our world today.

Accomplishments

Over the last six years the NSES Task Force, comprised of federal agencies and interested stakeholders, worked to identify a number of challenges and gaps that need to be addressed to support electronics stewardship in the U.S. and around the world. Most of the activities that Task Force members committed to under the NSES have been completed successfully. The few actions that have yet to be completed are either nearing completion or will require renewed focus and novel approaches to achieve the desired effect. The sections below reflect both the challenges and gaps identified as well as the Task Force's efforts to fill the gaps in pursuit of the four overarching NSES goals.

NSES Goal 1 - Incentivize the Design and Manufacture of Sustainable Electronics, to Include Safe Working Environments, Resource-Efficient Supply Chains, and Products Built for Reuse and Recycling:

<u>Challenges and Gaps</u>

- Identifying design and research challenges and opportunities.
- Promoting consumer purchasing of green electronics.
- Promoting scientific research and technical developments to improve recovery and market value of recycled materials (i.e., precious metals and rare earths).

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- Expanding green electronics certification programs.

Activities and Accomplishments

The U.S. Environmental Protection Agency (EPA) launched the Greener Products website to help purchasers find greener products, including sustainable electronics. Since its launch in April 2013, the Greener Products website has received almost 88,000 visitors. Executive Order 13693 directed agencies to buy environmentally sustainable electronic products, which meet *EPA's Recommendations of Specifications, Standards, and Ecolabels for Use in Federal Procurement*. EPA's recommendations encourage federal agencies to purchase Electronic Product Environmental Assessment Tool (EPEAT)[ii] registered comp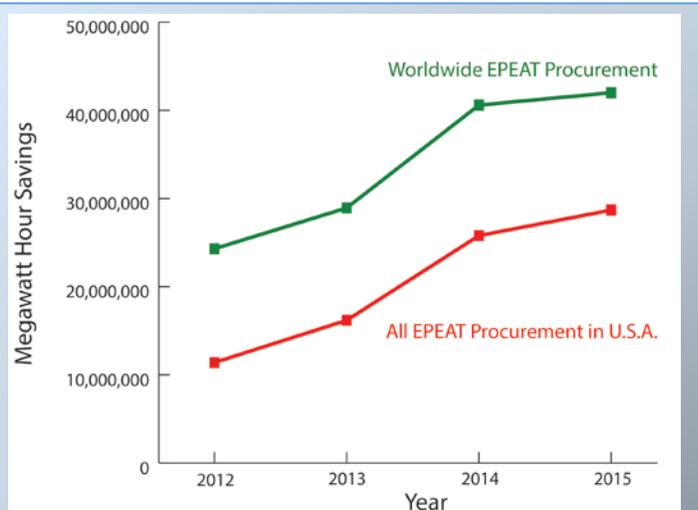uters, displays, imaging equipment, and televisions. The U.S. government's purchasing of sustainable electronics has significantly influenced and leveraged purchases made by other institutions both in the U.S. and globally. EPA conducted a series of trainings on the EPEAT® ecolabel and product registry, including a webinar entitled "It is Easy Being Green."[iii] - a Federal Acquisition Institute webinar had 2,056 live viewers and has received 378 additional views since being posted on the web.

> **Why EPEAT®- Registered Products?**
> EPEAT®-registered products contain fewer toxic materials, use less energy, last longer, use more recycled materials in the product and packaging, and are more easily recycled or upgraded than other electronics.

- New voluntary environmental performance standards for designing "green" televisions and imaging equipment (copiers and printers) have been completed and added to EPEAT®.[iv]
- The EPEAT® ecolabel and product registry expanded to include tablets, two-in-one notebooks, and portable all-in-one devices. Federal guidance was issued on purchasing EPEAT®-registered products in the new categories.[v]
- The EPA, U.S. Department of Energy (DOE), U.S. General Services Administration (GSA) and U.S. Department of Labor (DOL) are participating in ongoing work to develop voluntary sustainability standards for

Over their lifetime, EPEAT®-registered products show significant energy savings when compared to products that do not meet EPEAT® criteria.

servers and cell phones and to update the standard currently used by EPEAT® for computers and displays.
- DOE launched the Reducing Embodied-energy and Decreasing Emissions (REMADE) Institute, which is headquartered in Rochester, New York and led by the Sustainable Manufacturing Innovation Alliance. REMADE will leverage up to $70 million in federal funding, subject to appropriations, and will be matched by $70 million in private cost-share commitments from over 100 partners. The REMADE Institute will focus on reducing the cost of technologies needed to reuse, recycle and remanufacture materials such as metals, fibers, polymers and electronic waste. By enabling recycling and reuse, the

Institute will dramatically reduce the energy intensive processes of extracting raw materials and manufacturing the products, and will improve overall manufacturing efficiencies.

- DOE's Critical Materials Institute developed a new, low cost and sustainable process for the recovery of critical and valuable materials from scrap electronics.
- GSA launched a GreenCheck label so federal buyers can quickly and easily find government-wide contract vehicles on the Acquisition Gateway that meet federal green purchasing requirements. GSA launched GreenCheck first for government-wide contract vehicles that allow federal buyers to purchase information technology (IT) hardware.
- The Centers for Disease Control and Prevention's (CDC) National Institute for Occupational Safety and Health (NIOSH) published four health hazard evaluation reports looking at occupational hazards in the electronic scrap recycling industry and two peer-reviewed publications based upon these health hazard evaluations.
  - Metal Exposures at three U.S. Electronic Scrap Recycling Facilities[vi]. J Occup Environ Hyg. 2016 Dec 9:0. [Epub ahead of print] and Ceballos D, Gong W, Page E [2015].
  - A Pilot Assessment of Occupational Health Hazards in the U.S. electronic Scrap Recycling Industry[vii]. J Occup Environ Hyg 12 (7):482-288 doi: 10.1080/15459624.2015.1018516.
- NIOSH manages an ongoing project looking at possible occupational exposures to electronics recyclers of metals, flame retardants and other contaminants. A final report on the data from the first site is expected soon, and three additional sites for data collection have been identified.
- NIOSH established a blog entitled Occupational Exposures at Electronic Scrap Recycling Facilities.[viii]
- EPA convened a sustainable electronics forum to discuss major research challenges, policy issues and opportunities facing the management of electronic products. The forum resulted in the publication of a research roadmap that can serve to guide EPA and other stakeholders in prioritizing electronics-related research. [ix]
- EPA published *Rare Earth Elements: A Review of Production, Processing, Recycling, and Associated Environmental Issues*.[x]
- EPA funded small business innovation research which concluded that innovative high-speed technologies can be developed for rare earth element sorting in e-waste recycling applications.[xi]
- EPA funded small business innovation research resulting in identification of a scalable, environmentally friendly, low-cost methodology for recovery of specific rare earth elements from electronic components.*[xii]*
- EPA funded student research that developed tools to assist in recycling of liquid crystal displays for maximum resource recovery.[xiii]
- In order to develop better methods for managing e-waste, the e-Waste Challenge was launched by EPA at the Rio+20 UN Conference on Sustainable Development. Nine winning concepts were selected from among nearly 200 contributions, and are currently being implemented.[xiv]
- EPA funded the Tracking Molecular Components of Electronics Open Innovation Challenge; three winning concepts were chosen.[xv]

NSES Goal 2: Ensure the Federal Government Leads by Example

<u>Challenges and Gaps</u>

- Needing a comprehensive, government-wide policy on used federal electronics.

- Encouraging electronics manufacturers to expand their product takeback programs using certified recyclers.
- Encouraging the recipients of used federal equipment to use certified recyclers at the end of its useful life and improving tracking the flow of used federal equipment through its life cycle, including posting data.
- Directing federal government spending on electronics towards greener products to increase the availability of sustainable electronics for all.
- Expanding the use and efficiency of intergovernmental cooperation agreements between agencies to provide cost effective shipping of used electronics among responsible recycling and management.
- Characterizing and documenting markets and financial assistance opportunities associated with managing and recycling of used electronics.

Activities and Accomplishments

- GSA issued Federal Management Regulation (FMR) Bulletin B-34, *Disposal of Federal Electronic Assets*[xvi], providing guidance on the management of electronics used by the federal government, including requiring the use of certified refurbishers and recyclers, and prohibiting landfilling or incineration of used electronics.
- GSA advanced Final Rule FMR 102-36 to the point of final approval which incorporated the provisions of FMR Bulletin B-34. The Final Rule is under internal review and comment.

> ### Doing Our Part: Using Certified Recyclers
> Federal agencies reported disposing of federal property (including computers, laptops, and mobile devices) valued at over $39M* to certified electronics refurbishers or recyclers in FY15.
>
> *property is valued at Original Acquisition Cost (OAC))

- GSA developed the Agency Asset Management System[xvii] to facilitate the easy transfer of used electronics within a federal agency. In FY16, six agencies were using this System. Property valued over $6 million (original acquisition cost) was transferred through use of this tool.
- GSA revised its reporting tool to capture more detailed information on how agencies are disposing of their electronic assets. For example, the tool now captures if electronic assets are being sent to certified recyclers in an attempt to identify where used electronics are sent.[xviii]
- GSA released the guidance: *Strategies for Incorporating Electronic Assets Take-Back Provisions in Contracts and Leases*[xix], which had nearly 800 views on their website in the past year.
- EPA provided training on requirements to procure EPEAT®-registered products to the Federal Interagency Sustainable Acquisition and Materials Management Workgroup, the Interagency Federal Electronics Stewardship Working Group, the 2012 GreenGov Conference, and the AFCEA conference organized by GSA. Agency-specific training was also provided to the Tennessee Valley Authority, Office of Personnel Management, the Department of Treasury, the Department of Justice, the U.S. Postal Service, GSA, DOE, and the Department of Veterans Affairs.
- The Office of Management and Budget (OMB) issued Category Management Policy 15-1: *Improving the Acquisition and Management of Common Information Technology: Laptops and Desktops*. This Policy directs federal agencies to ensure that 80% or more of all computer laptops and desktops are bought using three major federal IT Government Wide Acquisition Contracts. All five of the standard

configurations in these contracts are required to be EPEAT® gold registered and ENERGY STAR® certified.

- OMB issued Category Management Policy 16-3: *Improving the Acquisition and Management of Common Information Technology: Mobile Devices and Services.* This policy directs federal agencies to consolidate procurement of mobile services, and establishes the Mobile Services Category Management Team. The team is responsible for integrating sustainability requirements into current and future federal mobile service solutions.

- In 2016, EPA published the *Implementation Study of the Electronics Recycling Standards: R2 and e-Stewards*®.[i] The study examined the implementation of the available electronics recycling standards in the United States – *R2:2013 - The Responsible Recycling ("R2") Standard for Electronics Recyclers*® and the *e-Stewards® Standard for Responsible Recycling and Reuse of Electronics Equipment© (e-Stewards®)* – to assess if the programs were transparent, consistent, and producing the intended results. The study found that the accreditation, certification, and implementation of the programs are working well, though opportunities for improvement exist. The study offers over 40 suggested strategies for consideration by an array of stakeholders in the electronics recycling community to improve the overall effectiveness of implementation. The standard owners are working to implement the recommendations to their programs, as appropriate.

> **Benefits of Agencies Buying Green**
> In 2015, the U.S. government purchased more than 2 million EPEAT® registered electronics. Compared to non-EPEAT products, the use of these electronics will, over their lifetime, provide the following benefits:
>
> - Save 16.7 million dollars of annual energy costs
> - Reduce energy use by 575,300 megawatt hours of electricity, enough to power more than 45,000 U.S. homes for a year
> - Reduce 402,300 metric tons of air emission, equivalent to taking 73,400 average cars off U.S. roads for a year
> - Reduce enough solid waste to equal the amount produced by 2,350 U.S. households
> - Eliminate 1489 metric tons of hazardous waste from the waste stream

- GSA and EPA are participating in the revision process for the R2 recycling standard. GSA and EPA have been invited to participate in the revision process for the e-Stewards® recycling standard when it begins.

- EPA is finalizing the *Minimum Environmental Criteria for Electronics Recycling Standards*, which will define the baseline for an electronics recycling standard to be considered acceptable for use by federal agencies. This report will inform the implementation of GSA's pending rule mandating federal use of certified recyclers. The final set of minimum criteria took into account available electronics recycling standards and the recommendations in EPA's *Implementation Study of the Electronic Recycling Standards: R2 and e-Stewards*®.

- The United States Postal Service (USPS) launched the BlueEarth® Federal Recycling Program[xx], a service for transporting used electronics to certified electronics recyclers. Most federal agencies use the BlueEarth program in their end-of-life management processes, and to provide free electronics and ink and toner cartridge recycling to their employees and contractors. In 2014, 16 agencies were enrolled; as of 2016, today there are 27 agencies enrolled. Electronic recycling activity reports are available to each agency.

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NSES Goal 3 - Increase Safe, Effective Management and Handling of Used Electronics in the United States

Challenges and Gaps

- Collaborating with stakeholders to increase used electronics collection, and provide solutions to electronics end-of-life management issues.
- Providing guidance to electronics recycling employers on offering facilities that offer safe and healthy working environments.
- Establishing approaches to gather, track, and provide access to information on the quantity and movement and flow of electronics within the U.S.

Urban Mining

One metric ton of circuit boards can contain 40 to 800 times the amount of gold and 30 to 40 times the amount of copper compared to one metric ton of virgin ore mined or extracted in the US.

Activities and Accomplishments

- Since 2014, the EPA's electronics recycling (eCycling) webpages have averaged 32,000 views per month, equating to about 384,000 views each year. These pages include information for the public about the SMM Electronics Challenge participants and their used electronics collection programs, as well as the awards received.
- Participants in EPA's SMM Electronics Challenge have been recognized through Champion Awards for their achievements in addressing electronics sustainability throughout the entire life cycle. To date, honorees have been awarded for implementing a uniquely robust used electronics collection program in all fifty states. They were also recognized for developing a closed loop plastics recycling stream for laptops, sustainable packaging made from wheat straw and mushrooms, and increasing recycled content and reducing energy consumption in smartphones.
- EPA hosted the SMM Electronics Reuse and Recycling Forum[xxi] with electronics stakeholders to harness the collective power of the electronics community and to identify shared priorities to advance domestic end-of-life electronics management. The top three areas participants were most interested in, and agreed would provide the largest positive change across the life cycle of electronic products were:

Industry Accepts the Challenge

EPA worked with industry stakeholders to launch a voluntary partnership program called the Sustainable Materials Management (SMM) Electronics Challenge. Since the program's inception in 2013, participants have sent more than 710,000 tons of used electronics to certified recyclers, resulting in the avoidance of more than 1.8 million tons of CO_2 emissions. This represents more than 18% of all used electronics collected in the U.S. over the same time period.

U.S. Consumer Electronics Recycling Rate, 2009-2014
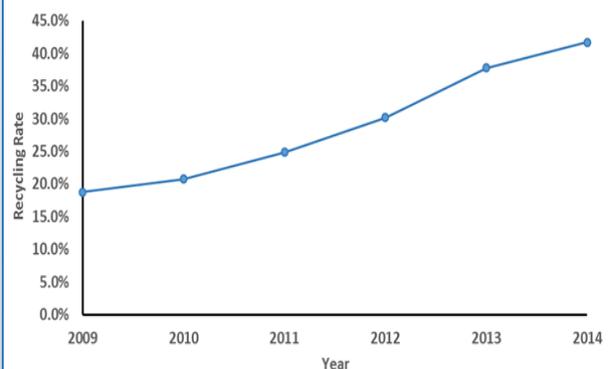
The 2014 electronics recycling rate can be found in the *Advancing Sustainable Materials Management: Facts and Figures 2014* report.

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- o Preventing improper management of hazardous materials and encouraging best management practices.
  - o Improving design for repair, reuse and recycling.
  - o Identifying best practices for verifying and selecting recyclers and refurbishers that adhere to responsible end-of-life electronics management processes.
- EPA launched and maintains a map of recyclers and refurbishers that are certified by third-party electronics recycling certification programs.[xxii] In 2015, an average of 761 people visited the site each month, equating to approximately 9,137 visitors for the year.
- The Occupational Safety and Health Administration (OSHA) developed a green jobs website[xxiii] which includes information on the hazards and precautions to be taken at electronics collection and recycling facilities.
- EPA supported development of the United Nations University's Solving the E-waste Problem (StEP) e-Waste Worldmap[xxiv] to provide country-level data on volumes of e-waste and transboundary flows.
- EPA continues to work on a model of domestic electronics flows. FY16 marked the first full year of this work, and ended with the development of a proof-of-concept model and methodology. The second phase of the project is to identify existing data on electronics flows to feed into the methodology, and to model flows for a specific state. Work will continue through FY19.
- OSHA is finalizing a guidance document that provides direction on safety and health management for e-waste recycling. This document is currently going through internal review and is expected to be released in 2017.
- As part of Bulletin B-34, GSA provided guidance to federal agencies to advise downstream recipients of used federal electronic assets on how to responsibly recycle them at the end of their useful life.

Certified Electronics Recyclers

Certified electronics recyclers are facilities that have been certified through third-party audits to be in conformance with the requirements of electronics recycling standards. The two available certification programs in the U.S. today are *R2:2013 - The Responsible Recycling ("R2") Standard for Electronics Recyclers*® and the *e-Stewards® Standard for Responsible Recycling and Reuse of Electronics Equipment*© (e-Stewards®). These standards provide criteria for the safe management of used electronics and data security.

Since the launch of NSES in 2011, the number of third-party certified recyclers has increased in the United States by more than 600%, from approximately 100 facilities to over 600 facilities. Globally, there are now over 110 certified recyclers located in 22 countries outside the U.S.

NSES Goal 4: Reduce Harm from U.S. Exports of e-Waste and Improve Safe Handling of Used Electronics in Developing Countries

Challenges and Gaps

- Needing information on trade flows and handling of used electronics, and facilitating the sharing of information with federal and international agencies within legal limits.
- Providing technical assistance and establishing partnerships with developing nations to better manage used electronics.
- Working with exporters to explore how to encourage safe handling of re-manufactured, recycled, and used electronics in the U.S. and abroad.
- Proposing regulatory changes to improve compliance with existing regulations that govern cathode ray tubes (CRTs), and providing more information on CRTs that are destined for reuse and recycling.
- Supporting ratification of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

Activities and Accomplishments

- The U.S. International Trade Commission published *Used Electronic Products: An Examination of U.S. Exports.*[xxv] U.S. organizations reported $20.6 billion in total sales of used electronics in 2011. This figure was composed of $19.2 billion of domestic sales and U.S. exports totaling $1.45 billion, or 7% of total sales.
- With funding from EPA, the United Nations StEP Initiative (*Solving the E-waste Problem*), along with the Massachusetts Institute of Technology and the National Center for Electronics Stewardship, published *Quantitative Characterization of Domestic and Transboundary Flows of Used Electronics: Analysis of Generation, Collection, and Export in the United States*[xxvi] and *Transboundary movements of used and waste electronic and electrical equipment: Estimates from the European Union using trade statistics.*[xxvii]
- EPA supported StEP in conducting an analysis of Ethiopia's e-waste situation[xxviii], which resulted in recommendations to develop a sustainable e-waste recycling center, and the establishment of the E-waste Management Project in Ethiopia.
- EPA and Taiwan worked together to lead the International E-Waste Management Network[xxix], which enabled environmental officials from Asia, Africa, Latin America, and the Caribbean to directly exchange best practices of e-waste management.
- As a member of the Commission for Environmental Cooperation, the U.S. government supported the now completed project, Sound Management of Electronic

Informal to Formal Recycling

Through the "Border 2020: US-Mexico Environmental Program" EPA is collaborating with the Border Environmental Cooperation Commission (BECC) and other bi-national partners to implement a three-year (2015-2017) pilot project in Mexicali, Mexico promoting safer e-waste recycling practices including strategies to transition the informal labor sector into the formal labor economy. The project, funded by the Inter-American Development Bank thru BECC and Border 2020, has completed several activities among them training of informal and formal recyclers; community e-waste collection events; a public outreach campaign to raise awareness on e-waste issues and best management practices; and a literature and field assessment of e-waste practices in Mexicali and globally to inform the development of the informal sector e-waste recycling strategy.

Wastes in North America.[xxx] As part of the project, training was developed for North American small and medium-size businesses who recycle and refurbish used and end-of-life electronics.[xxxi] The initial training sessions included over 120 recyclers from Canada, Mexico and the U.S.

- EPA published the final revisions to the Export Provisions of the Cathode Ray Tube Rule. [xxxii] The revisions allow EPA to better track exports of CRTs for reuse and recycling in order to ensure safe management of these materials. EPA developed and maintains a webpage listing companies that have been approved to export whole CRTs, broken CRTs, or unprocessed CRT glass for recycling.[xxxiii] EPA also maintains a webpage listing companies that have submitted written notifications to inform EPA of their intention to export used, intact CRTs for reuse.[xxxiv]

- EPA developed and maintains a webpage of frequent questions and answers, to help ensure compliance with CRT regulations.[xxxv]

- EPA proposed and finalized revisions to the export provisions of the CRT exclusion as part of the Hazardous Waste Export-Import Revisions. These revisions 1) link the consent to export CRTs for recycling with the electronic export information submitted to U.S. Customs and Border Protection; and 2) convert CRT export notices for recycling and of annual reports on CRT exports for recycling to electronic submissions by using EPA's Waste Import Export Tracking System. The final rule was published on November 28, 2016, and became effective on 12/31/2016.[xxxvi]

- The Commission for Environmental Cooperation implemented a study to estimate the quantity of used computers and monitors that are generated, collected, and exported within, between, and from Canada, Mexico, and the U.S., to the rest of the world. The study, entitled *The Quantitative Characterization of Domestic and Transboundary Flows of Used Electronic Products. Case Study: Used Computers and Monitors in North America*, was prepared by the Massachusetts Institute of Technology and other academic institutions. The work was overseen by a steering committee of representatives from the EPA and the environmental agencies of Canada and Mexico.[xxxvii]

Looking Ahead

Electronic devices and technologies continue to advance and increase in type and number. It is clear that our society will continue to incorporate these devices into our daily activities and that electronics will increase throughout our homes, automobiles, offices and the world. Our growing reliance on these products highlight the need for us to take a long-term sustainable approach towards electronics stewardship, which is why the NSES was first developed.

The NSES is the roadmap for the United States to ensure that electronics are designed, purchased and managed in a sustainable manner that is protective of human health and the environment from harmful effects associated with the unsafe handling and disposal of used electronics. It is encouraging that the NSES has accomplished so much in the short six years it has been in existence, but more work is needed if we are to keep pace with the emerging challenges that surround the constantly advancing electronics industry. New and existing issues, knowledge gaps, and other challenges emphasize the continued need for a strong framework that addresses electronics sustainability issues wherever and whenever they arise.

[i] https://www.epa.gov/smm/advancing-sustainable-materials-management-facts-and-figures/
[ii] http://www.epeat.net/
[iii] https://www.fai.gov/media_library/items/show/63

iv http://www.epeat.net/

v http://energy.gov/sites/prod/files/2014/12/f19/EPEAT%20Registered%20Products%20Memo%2010-31-14_0.pdf

vi http://www.tandfonline.com/doi/full/10.1080/15459624.2016.1269179

vii https://blogs.cdc.gov/niosh-science-blog/2014/09/30/escrap/

viii https://blogs.cdc.gov/niosh-science-blog/2014/09/30/escrap/

ix https://nepis.epa.gov/Adobe/PDF/P100ISC9.pdf

x http://nepis.epa.gov/Adobe/PDF/P100EUBC.pdf

xi https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/10019/report/F

xii https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/9665/report/F

xiii https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/9847/report/F

xiv https://challenges.openideo.com/challenge/e-waste/brief

xv https://www.innocentive.com/ar/challenge/9932945/

xvi http://www.gsa.gov/graphics/ogp/FMR_Bulletin_B-34.pdf

xvii http://www.gsa.gov/portal/content/100746

xviii https://d2d.gsa.gov/report/gsa-ogp-personal-property-dashboard/

xix https://www.fedcenter.gov/Documents/index.cfm?id=28559&pge_prg_id=40575&pge_id=3309

[i] https://www.epa.gov/smm-electronics/implementation-study-electronics-recycling-standards-r2-and-e-stewards

xx http://blueearth.usps.gov/

xxi https://www.epa.gov/smm-electronics/summary-report-about-sustainable-materials-management-smm-electronics-reuse-and

xxii https://www.epa.gov/smm-electronics/certified-electronics-recyclers#04

xxiii https://www.osha.gov/SLTC/recycling/index.html

xxiv http://www.step-initiative.org/step-e-waste-world-map.html

xxv https://www.usitc.gov/publications/332/pub4379.pdf

xxvi http://www.step-initiative.org/files/step/_documents/MIT-NCER%20US%20Used%20Electronics%20Flows%20Report%20-%20December%202013.pdf

xxvii http://www.step-initiative.org/files/step-2014/Publications/Green%20and%20White%20Papers/UNU-Transboundary-Movement-of-Used-EEE.pdf

xxviii http://www.step-initiative.org/news/step-green-paper-explores-e-waste-situation-and-management-possibilities-in-ethiopia.html

xxix https://www.epa.gov/international-cooperation/international-e-waste-management-network-iemn

xxx http://www.cec.org/our-work/projects/sound-management-electronic-wastes-north-america

xxxi http://www.cec.org/tools-and-resources/esm-material/cec-training-materials-environmentally-sound-management

xxxii https://www.epa.gov/hw/final-rule-revisions-export-provisions-cathode-ray-tube-crt-rule

xxxiii https://www.epa.gov/hwgenerators/companies-approved-november-3-2016-export-cathode-ray-tubes-crts-recycling

xxxiv https://www.epa.gov/hwgenerators/companies-exporting-cathode-ray-tubes-reuse

xxxv https://www.epa.gov/hw/frequent-questions-about-regulation-used-cathode-ray-tubes-crts-and-crt-glass

xxxvi https://www.epa.gov/hwgenerators/final-rule-hazardous-waste-export-import-revisions

xxxvii http://www3.cec.org/islandora/en